SUMMARY REPORT OF THE FALL 1987 U.S. EPA FISH AND SEDIMENT SAMPLING SURVEY OF THE MIDDLE FORK LITTLE BEAVER CREEK

RUETGERS-NEASE CHEMICAL COMPANY, INC. SITE, SALEM, OHIO

Prepared by Black & Veatch
Work Assignment Number: 04-5PA3
January 6, 1989

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1.0 INTRODUCTION

From 1961 until 1973 the Nease Chemical Company owned and operated a chemical manufacturing plant near Salem, Ohio. Chemicals such as pesticides, fire retardants, cleaning compounds and other agricultural and pharmaceutical products were produced. In 1973 the plant was closed by the Ohio Environmental Protection Agency (OEPA) for wastewater discharge violations.

The 44 acre site drains to Middle Fork Little Beaver Creek. Contaminants were found in past surveys by Ruetgers-Nease Chemical Company (Nease) in the sediments, surface water and groundwater, both on and off-site.

Limited remedial action has been performed by Nease since the closure of the plant to alleviate some of the problems. This remedial action included removal of quantities of soils from known areas of contamination and installation of a leachate collection system to collect contaminated groundwater. However, despite these interim remedial actions, sampling surveys undertaken by OEPA in 1985 and 1987 identified the presence of contaminated fish in Middle Fork Little Beaver Creek (the major stream).

Further sampling was undertaken in the Fall of 1987 by the U.S. Environmental Protection Agency (U.S. EPA) to confirm the presence of mirex and its degradation products in fish; to assess whether the stream bed sediments are contaminated; and to give an indication as to the general water quality of the stream. This report provides a summary of that sampling effort.

A remedial investigation/feasiblity study (RI/FS) is currently being conducted by Nease, under the direction of the U.S. EPA and OEPA. This RI/FS is a more complex investigation into the extent of the contamination caused by the Nease Site. The study includes soil, air, sediment, fish and water sampling to identify the contamination problems associated with the site. The study is followed by evaluation of methods to remediate the problems.

2.0 SAMPLING

Four trips to the site were conducted to obtain the necessary samples for analysis.

A reconnaissance trip provided a general understanding of the area. Based on this reconnaissance trip, twenty two (22) sampling sites were identified by the U.S. EPA. Three additional trips were then made to obtain the required samples.

The sampling sites were chosen along 37.6 miles of stream between the Nease Site and the Ohio River (Figure 1 U.S.EPA Sampling Site Locations). Two types of sample were collected, whenever possible, from each site. These sample types were fish and sediments.

The type of sample taken from each sampling site is listed in Table 1. Samples from Middle Fork Little Beaver Creek downstream from the Nease site formed the basis of the study. Samples were also collected upstream of the Nease site and in other tributaries to Middle Fork Little Beaver Creek to serve as general reference points (i.e sample stations 1,2,12,13,19, and 21). Additional sediment samples were collected at stations 28,29,30 and 31, near previously selected sites 6 and 7.

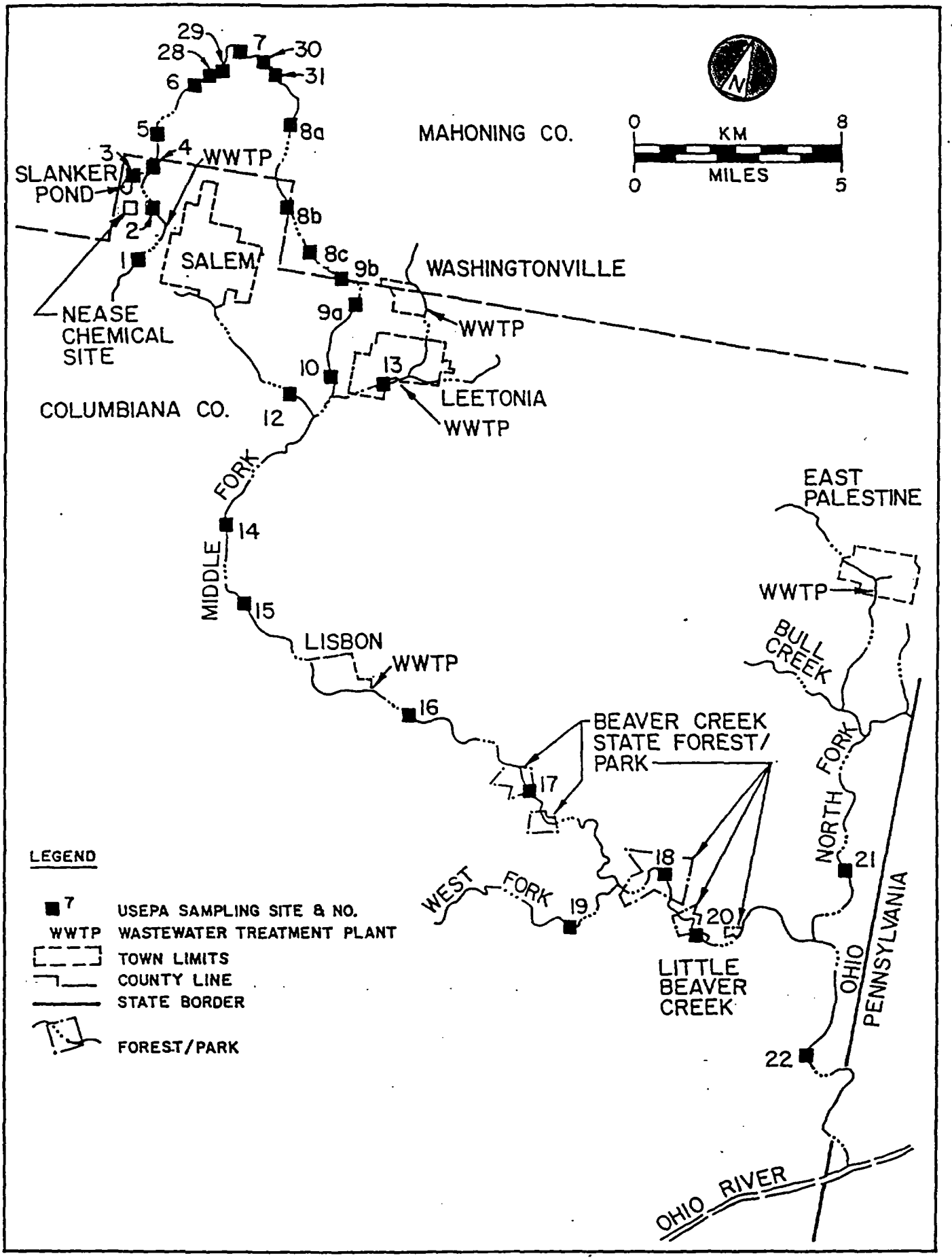

FIGURE 1
USEPA SAMPLING SITE LOCATIONS

TABLE 1
SAMPLE TYPES BY STATION
(for use with Figure 1)
F = Fish S = Sediment

Sample Station	Sample(s) taken
1	S
2	S
3a	F,S
3b	S
3c	F,S
3d	S
4	S
5	F,S
6	F,S
7	F,S
8a	F,S
8b	F,S
8c	F,S
9a	F,S
9b	S
10	F,S
12	S
13	F,S
14	F,S
15	F,S
16	F,S
17	F,S
18	F,S
19	F,S
20	F,S
21	F,S
22	F,S
28	S
29	S
30	S
31	S

2.1 FISH SAMPLES

Fish samples were obtained using nets and fish shockers. Immediately following capture the fish were identified, weighed, measured and deep frozen. They remained frozen until analysis was performed by the laboratory.

Great care was taken in choosing fish representing two food chain levels, also known as trophic levels. The upper trophic

level consists of fish such as Bass and Bluegill that feed mainly on smaller fish such as minnows. The lower trophic level consists of bottom feeders such as Carp, Suckers and Bullhead Catfish that feed mainly on organic matter that sinks to the stream bottom.

Due to bioaccumulation of mirex up the foodchain, the upper trophic level fish may be more contaminated than the lower trophic level fish.

2.2 SEDIMENT SAMPLES

Sediment samples were taken from the top six inches in the most likely contaminated areas of the creek. These areas included the deeper, slower flowing parts of the creek where sediment is likely to accumulate. A dredge was used to obtain samples from deep water areas.

3.0 DISCUSSION OF RESULTS

Results for fish and sediment samples are listed in Tables 2 and 3 and shown in Figures 2,3, and 4.

The results indicate that the Nease specific compound mirex, a fire ant pesticide and fire retardant, has contaminated sediments and accumulated in upper and lower trophic level fish.

The U.S. EPA Fall 1987 survey data has shown that fish tissue samples for upper trophic level fish (i.e. Bass and Bluegill) in all nine stations between the site and Lisbon Dam ranged from a high of 5400 microgram per kilogram (ug/kg) or parts per billion (ppb) near the site to a downstream low of 62 ppb (Figure 2). The U.S. EPA 1987 survey results indicate that the sediments are contaminated with mirex starting just downstream from the site. These sediments have concentrations of mirex ranging from 1500 ppb by the site to 38 ppb in downgradient areas (Figure 4). No mirex was detected in sediments past the Lisbon Dam.

TABLE 2
FISH TISSUE RESULTS
(Concentrations in ppb (ug/kg))

Sample	Trophic Level	Fish	Mirex	Photomirex	Diphenyl-Sulfone
3A	U	Crappie	N/D	N/D	N/D
3A	L	White Suckers	71	--	--
3C	U	Bluegill	N/D	N/D	N/D
3C	L	Not/Collected	--	--	--
5	U	Bluegill	5400	280	15
5	L	Carp	87	N/D	8.5
6	U	Bluegill	170	N/D	30
6	L	Carp	260	N/D	9.5
7	L	Catfish	300	N/D	N/D
7	L	Carp	190	N/D	N/D
8A	U	Not/Collected	--	--	--
8A	L	Carp	1300	N/D	N/D
8B	U	Sunfish	670	N/D	N/D
8B	L	White Suckers	430	N/D	N/D
8C	U	Sunfish	560	47	N/D
8C	L	Suckers	330	N/D	N/D
9A	U	Shiners	53	50	46
9A	L	Carp	160	N/D	N/D
10	U	Bass	90	N/D	N/D
10	L	Carp	N/D	N/D	N/D
13	U	N/A	--	--	--
13	L	Chubs	70	N/D	N/D
14	U	Bass	2000	N/D	N/D
14	L	Suckers, Hog	100	N/D	N/D
15	U	Shiners	62	N/D	N/D
15	L	Suckers, Hog	130	N/D	N/D
16	U	Rock Bass	N/D	N/D	N/D
16	L	Catfish	N/D	N/D	N/D
16	L	Carp	96	N/D	N/D
17	U	Bass, Rock	37J	N/D	N/D
17	L	Suckers, Hog	N/D	N/D	N/D
18	U	Bass, Rock	140	N/D	340
18	L	Suckers, Hog	N/D	N/D	N/D
19	U	Bass, Sm.	N/D	N/D	N/D
19	L	Suckers, Hog	N/D	N/D	N/D
20	U	Bass	350J	N/D	N/D
20	L	Suckers, Hog	N/D	N/D	N/D
21	U	Bass, Rock	N/D	N/D	N/D
21	L	Chubs	N/D	N/D	N/D
22	U	Bass, Sm.	N/D	N/D	N/D
22	L	Suckers	N/D	N/D	N/D

*** - N/D meaning: Not detected at scan level of 60 ppb (40 ppb less than the accepted 100 ppb action level for mirex).**

J = Estimated value, may be higher or lower than stated.

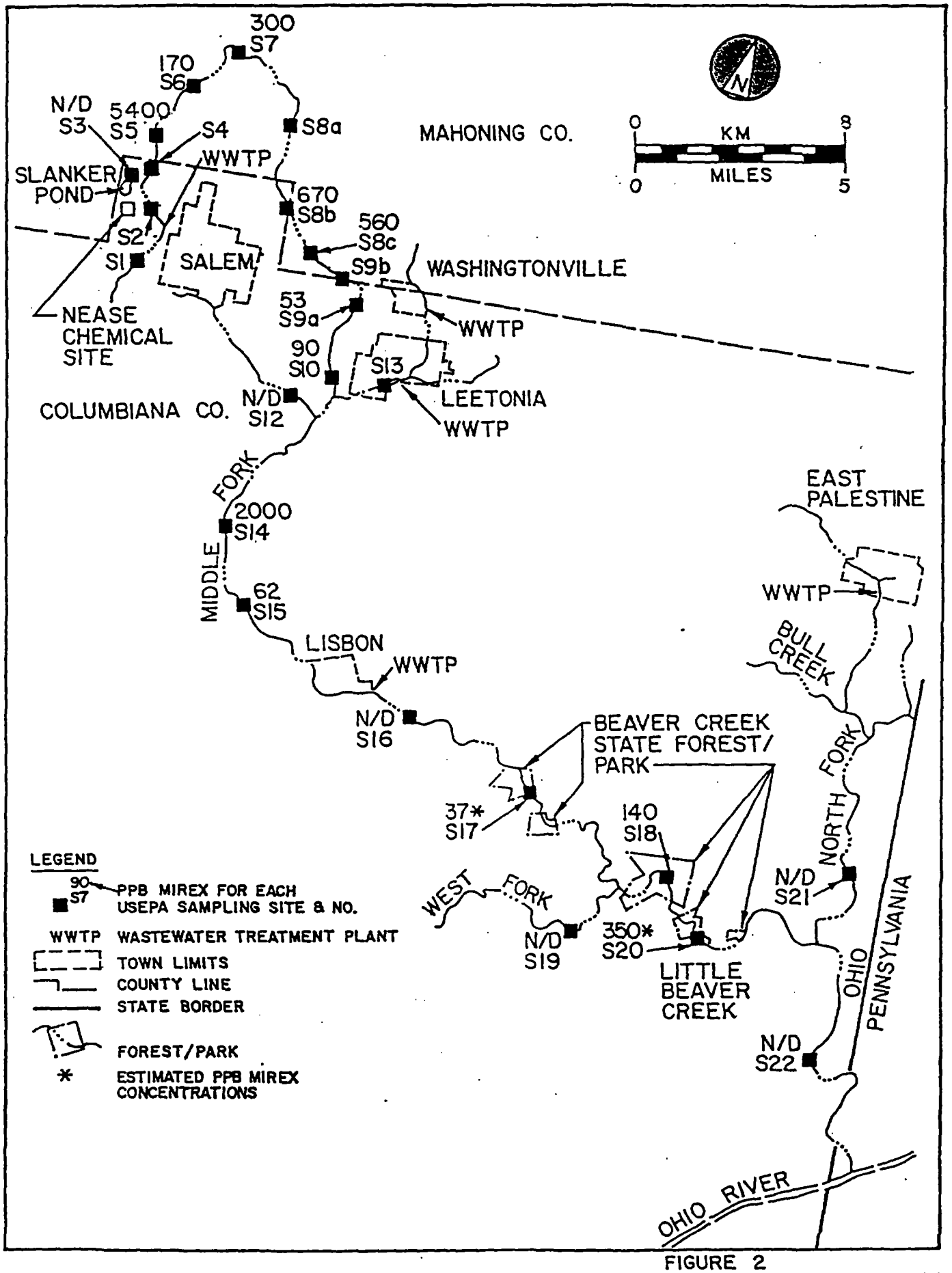

FIGURE 2
RESULTS OF FISH SURVEY
(UPPER TROPHIC LEVEL)

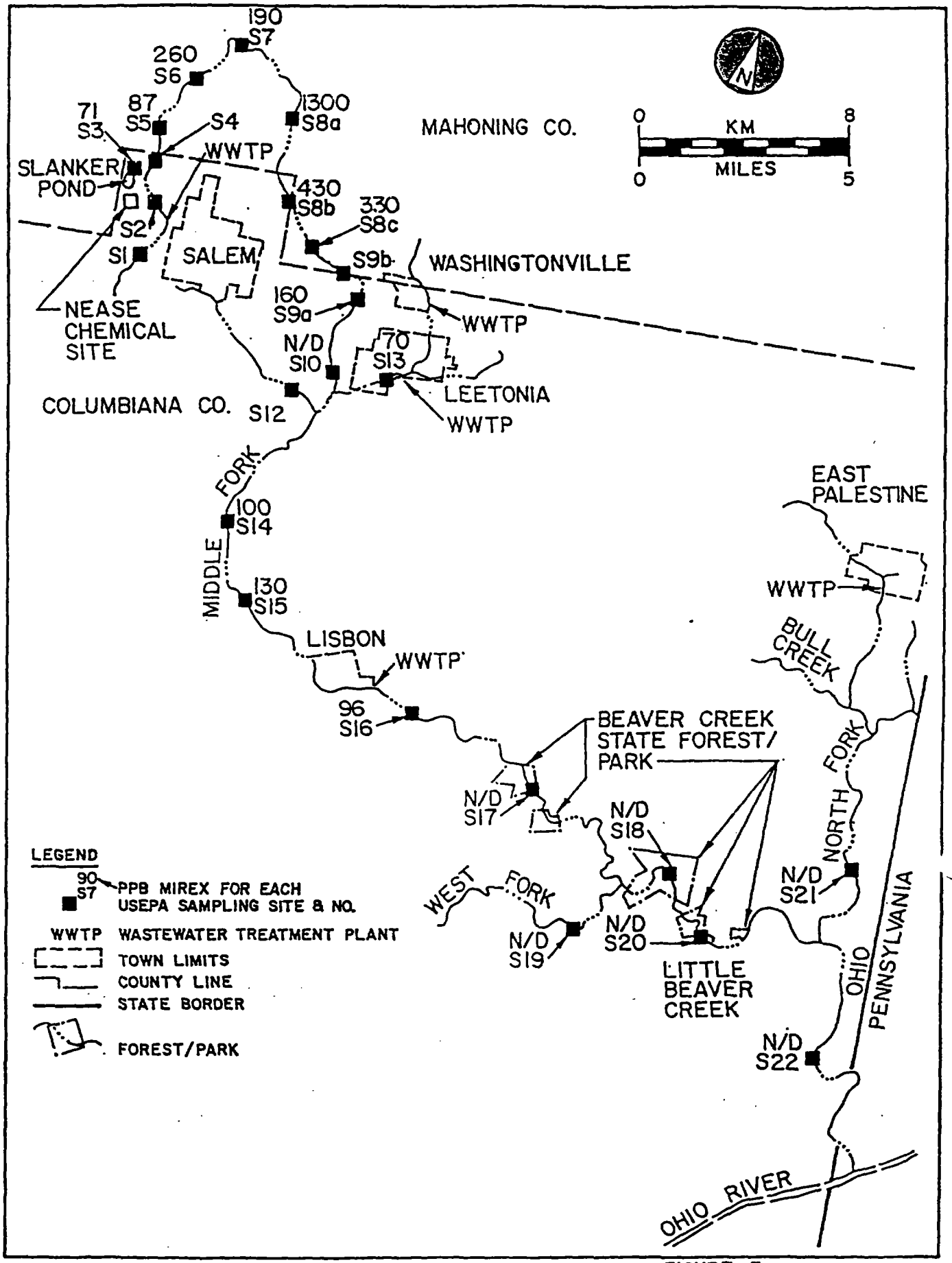

FIGURE 3
RESULTS OF FISH SURVEY
(LOWER TROPHIC LEVEL)

TABLE 3
SEDIMENT/SOIL RESULTS
(Concentrations in ppb (ug/kg))

Sample	Mirex	Photomirex	Diphenylsulfone
1	N/D	N/D	N/D
2	N/D	N/D	N/D
3A	N/D	N/D	N/D
3B	N/D	N/D	N/D
3C	35	N/D	N/D
3D	N/D	N/D	N/D
4	1500	N/D	N/D
5	640	N/D	63
6	340	N/D	31
7	N/D	N/D	N/D
8A	N/D	N/D	N/D
8B	150	N/D	N/D
8C	90	N/D	49
9A	38	N/D	12
9B	230	N/D	19
10	N/D	N/D	110
12	N/D	N/D	N/D
13	N/D	N/D	N/D
14	N/D	N/D	40
15	N/D	N/D	N/D
16	N/D	N/D	N/D
17	N/D	N/D	N/D
18	N/D	N/D	N/D
19	N/D	N/D	N/D
20	N/D	N/D	N/D
21	N/D	N/D	N/D
22	N/D	N/D	N/D
28	510	N/D	N/D
29	1400	N/D	N/D
30	220	N/D	N/D
31	1500	N/D	44J

*** - N/D meaning: Not detected at scan level of 60 ppb.**

J = Estimated value - may be higher or lower than stated.

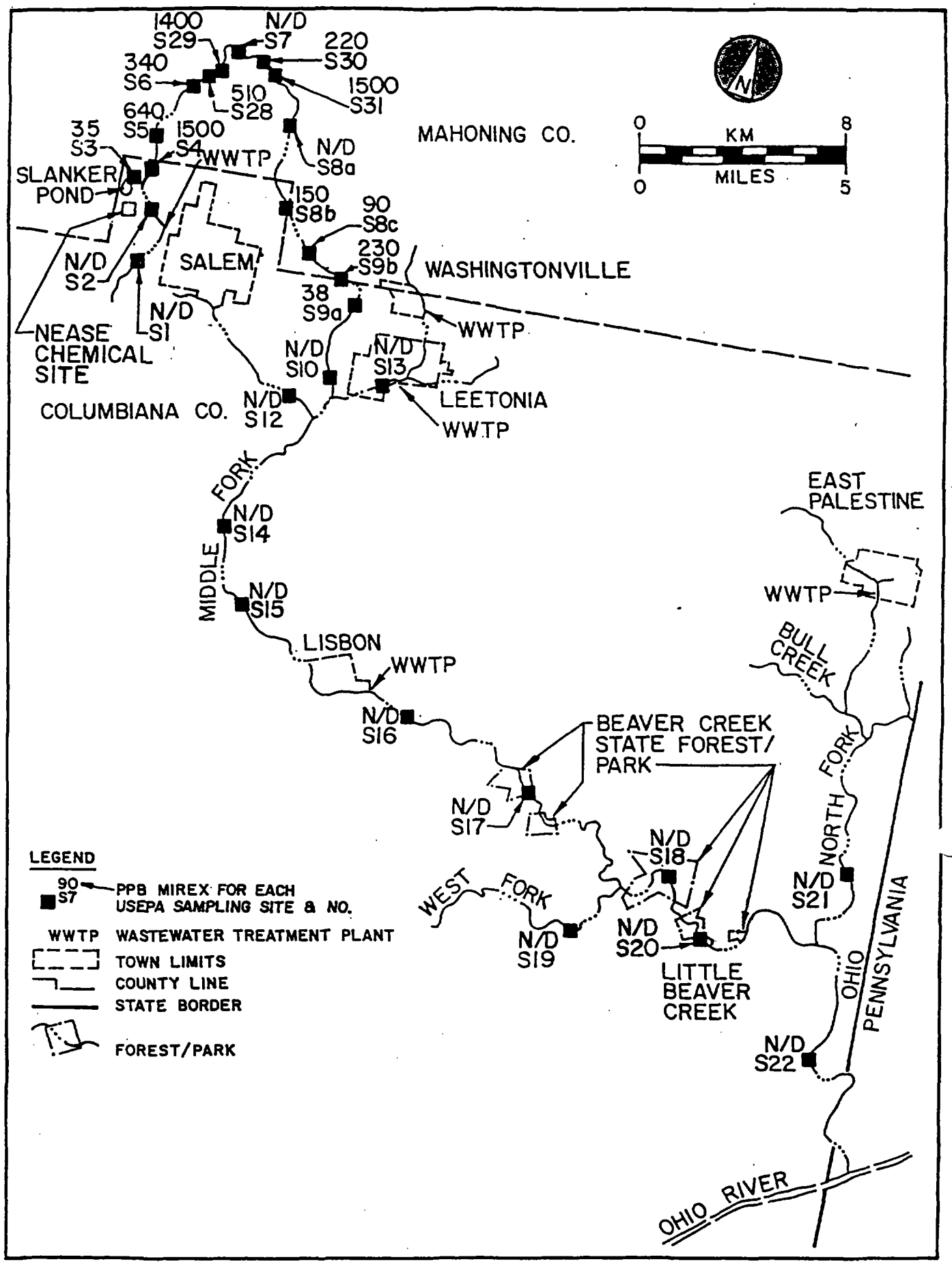

FIGURE 4
RESULTS OF SEDIMENT SURVEY

The highest concentration of mirex in the fish and sediment samples were by the site. The contamination decreased in Middle Fork Little Beaver Creek, downstream of these high areas but increased again in the sediment depositional zone of Egypt swamp (sample stations 8b and 8c). This information supports the Ohio Department of Health (ODH) issuance of a direct contact and fish consumption advisory in the upper portions of Middle Fork Little Beaver Creek.

The U.S. EPA 1987 survey also indicates that fish tissues from upper trophic level fish are contaminated with mirex in some stations from the Lisbon Dam to the Ohio River. In three of the five stations, the concentrations ranged from an estimated 350 ppb to an estimated 37 ppb. Estimated values are used when the exact amount of mirex in the fish cannot be determined during analysis. Mirex was detected in some stations in the Beaver Creek State Forest/Park which is about halfway between the Lisbon Dam and the Ohio River. This stretch of Middle Fork Little Beaver Creek is called Little Beaver Creek and is a state wild and scenic river. This information indicates that mirex is adversely impacting the quality of fish downstream of the Lisbon Dam.

Based on all the chemical and physical data gathered by Nease, U.S. EPA and OEPA, U.S. EPA believes that the mirex contaminated sediments and fish in Middle Fork Little Beaver Creek are due to past sloppy operations and wastewater discharge violations at the Nease facility. These actions caused mirex to flow into Middle Fork Little Beaver Creek where it was adsorbed on to sediment particles.

Contaminated sediments have settled to the creek bottom and/or have been transported downstream with the current. Mirex degrades very slowly only under exposure to sunlight (photoxidation) and will therefore remain adsorbed to the sediment for a long time. These contaminated sediments are the source of the mirex that eventually accumulate in fish.

There are two bioecological pathways that mirex can take to go from the sediment to the fish. The main pathway is for mirex to move up the food chain by first being taken up by algae and plants from sediments and then accumulates in aquatic insects as they consume the algae or plants. Aquatic insects then transfer mirex to fish when the fish eat the insects. A secondary pathway of mirex accumulation in fish is the absorption of mirex by fish as contaminated water or sediment moves over the fishes gills.

Mirex was observed in fish samples in areas where mirex was not detected in sediment. This observance may be accounted for by the downstream drifting of contaminated vegetation or insects from a contaminated stretch of Middle Fork Little Beaver Creek to uncontaminated stretches, where they are consumed by insects or fish, respectively. This type of mirex movement may account for the detection of mirex in fish living in reaches of the creek where there are no contaminated sediments.

The fact that fish are contaminated in areas where no sediments appear to be contaminated may also be due to the migration of impacted fish from known areas of sediment contaminated downstream to areas of no sediment contamination.

The U.S. EPA and OEPA will be directing Nease in further study of Middle Fork Little Beaver Creek, as a part of the RI/FS for the site. During this study a large number of surface water, sediment, fish and benthic samples will be collected and analyzed for many chemicals, including mirex. The results of this survey will be utilized in conjunction with the past OEPA studies in 1985 and 1987 and the U.S. EPA 1987 investigation to more precisely delineate the contaminated areas of Middle Fork Little Beaver Creek and more precisely define the movement of mirex in the environment.

4.0 CONCLUSIONS

1. The fish in the Middle Fork Little Beaver Creek exhibit mirex contamination, especially those fish in the upper trophic level and those fish close to the Nease Site.

2. Sediment contamination is evident, especially in areas close to the Nease Site.

3. Mirex is observed in fish at a considerable distance from the source of contamination.

5.0 SUMMARY

Previous studies by the OEPA that tentatively identified the presence of contaminated fish have now been verified by the U.S. EPA Fall 1987 survey. This survey provides an indication of the extent of contamination in both the fish population and the sediments in Middle Fork Little Beaver Creek.